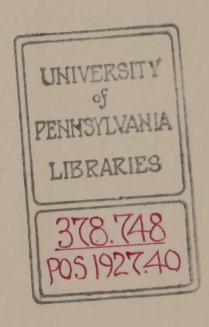
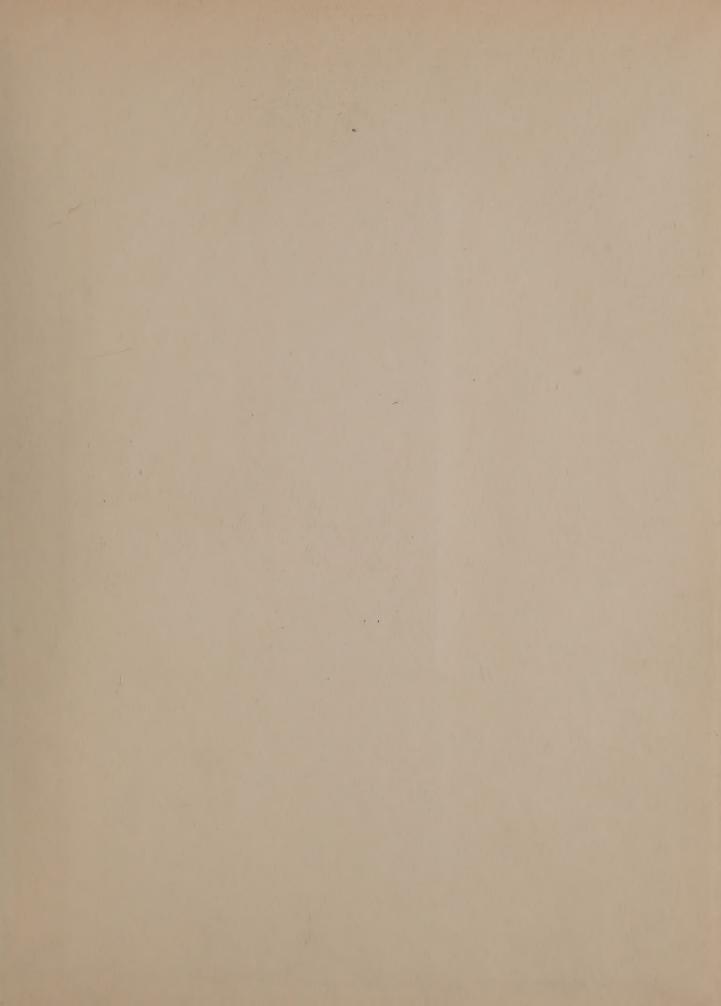
POSTOPERATIVE GAS BACILLUS INFECTION

OF THE ABDOMINAL WALL

BUTLER

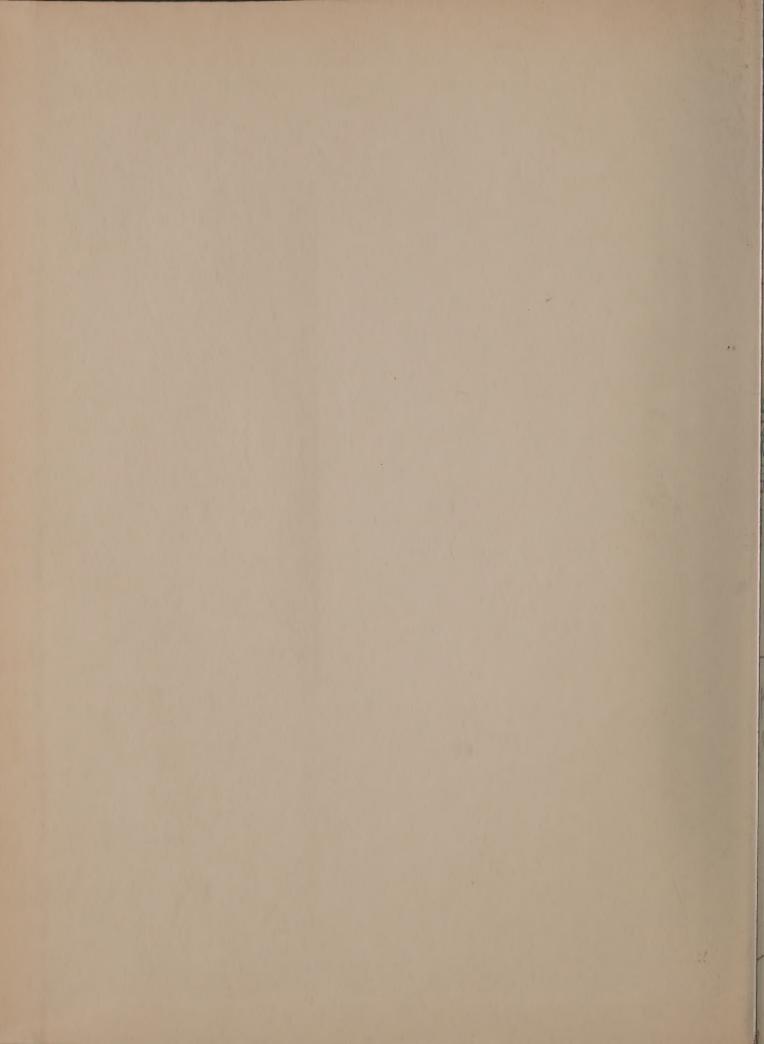
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FOR ANNALS OF SURGERY

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SEP 27 1926

STOPERATIVE GAS BACILLUS INFECTION OF THE

ABDOMINAL WALL

FOR ANNALS OF SURGE

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Cas bacillus infection of the abdominal wall is a very rare complication following laparotomies. In spite of abundant literature on the fecal anaerobes and infections caused by them, extensive search has revealed only a few references to this particular condition. Its serious import when it does occur, and the appearance of two cases at the Robert Packer Hospital, within two years, have prompted a study to determine what risk of such infection besets the average patient.

In this discussion gas bacillus infection includes all infections caused by fecal anaërobes, such as Bacillus tetani, B. Welchii, Vibrian septique, B. oedematiens, B. fallox, B. sporogenes, B. histolyticus, B. putrificus, etc. Those mentioned are the most frequently encountered anaërobic bacilli and clinically the most important. Of this group B. Welchii is undoubtedly of prime importance.

The Robert Packer Hospital is situated in an agricultural district. Within a radius of 100 miles there are only thirteen cities of 25,000 or more population. One-half or more of its patients are farmers or are engaged in outdoor rural occupations. The frequency of anaërobes in such an environment should be greater than in the metropolitan districts. This presumption is strengthened by the fact that during the period covered by this report there occurred, in addition to the cases already mentioned, five cases of tetanus and three cases of

X Short thesis required for M.S. degree by the Post-Graduate School of the University of Pennsylvania.

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gas bacillus infection of other parts as follows: knee, arm and leg. However, during the past fifteen years of this hospital's present management, postoperative gas bacillus infection has occurred only twice in approximately 7000 laparotomies.

In view of the known habitat of the fecal anaërobes, a study of the intestinal flora of this particular district was undertaken, even though similar studies had been made by other observers in other districts. A review of the other reports reveals many discrepancies.

Dungeon and Sargentl in a study of the bacteriology on appendices in England in 1905, found no anaërobes. On the other hand, Lanz and Tavel² found bacillus edematis maligni in 49 out of 139 cases of appendicitis. Under bacillus edematis maligni they included various other anaërobes, including bacillus Welchii. Runeberg³ in 1908 found bacillus Welchii once in 14 cases of appendicitis. Hyde and Frederick's Clinic in Marburg⁴, in 1911, concluded that anaërobic bacteria were found in 100 out of 102 cases of appendicitis studied. Grigoroff⁵ found bacillus Welchii present nine times in 31 cases of appendicitis. Sinomds⁶ and Jennings⁷ had similar results. Welch⁸, Flexner⁹, Wright¹⁰, Stokes¹¹ and others were able to isolate bacillus Welchii from 22 per cent. of peritoneal exudates following peritonitis.

Winter¹² in 1889 was the first to describe emphysema of the abdominal wall after laparotomies, and reported two cases. Madalener¹³ reported two more cases, and claimed that the posture with the hips elevated was of predisposing moment in the origin of the emphysema, while Leopold and Brosin¹⁴ had already proved that the condition could arise after operations, regardless of the patient's position. Heil¹⁵ contended that emphysema could only develop after imperfect closure of the incision. He collected 20 cases from the literature.

testions which where the care of the contract of the contract of donte I was ther languages, on secondary the last term of think . nother og staneit or sat it see for her . erotatingo until seeme of Russell¹⁶ reported two suges in 1897 from the gynacological service of Johns Hopkins Hospital, one following suspension of the uterus for retroflexion, the other following a panhysterectomy in which the intestine was inadvertently opened.

Among the cases collected by Drs. Welch and Flexner¹⁷ are several following perforation of the gut, showing that the organisms must exist in the intestine. This is of particular interest when one considers the frequency of intestinal injuries in abiominal operations.

None of the above cases were bacteriologically proved.

In very recent literature two cases have been reported of true gas bacillus infection of the abdominal mall. Bier18 reported a case which developed in forty-eight hours after appendentomy. Under appropriate treatment, instituted early, the patient made a good recovery.

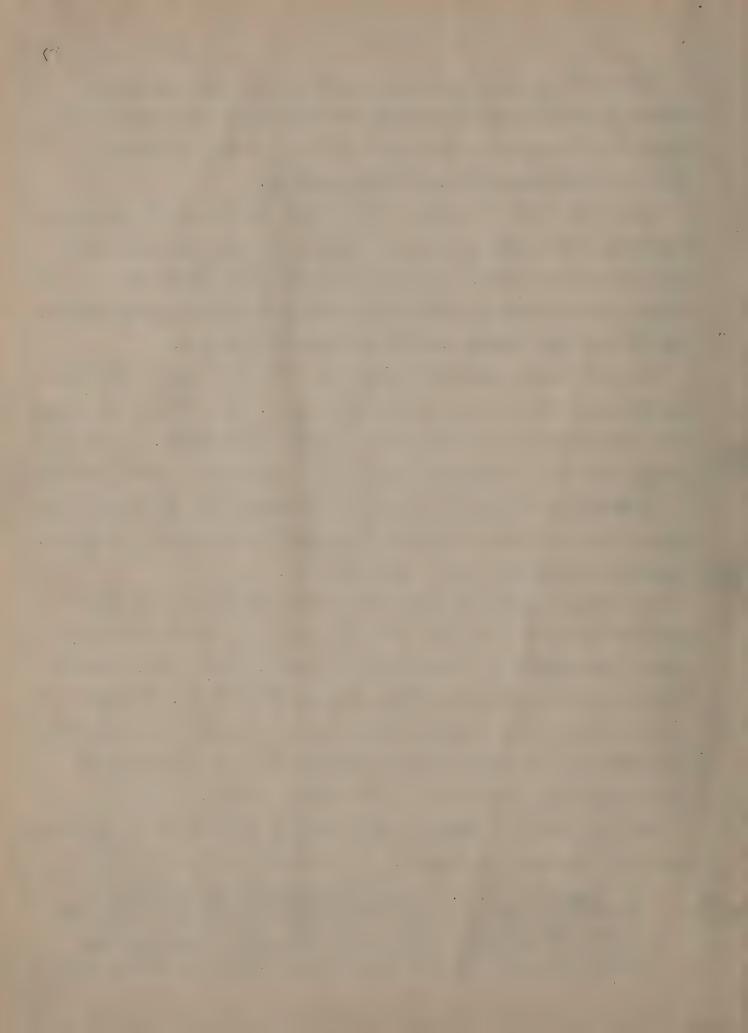
Ochener and Schmidt¹⁹ reported a case developing after an appenacctomy for a perforated appendix associated with abscess formation. Likewise this patient made a good recovery.

An extraordinary case has been reported by Daton 0, of gas bacillus infection involving the neck, supra- and infra-clavicular spaces, following a perforated gastric ulcer. Papid involvement of the entire body took place within an hour after death. Necropsy revealed the presence of gas bubbles in the stomach wall, suggesting that here was the seat of primary infection, particularly as no gas bubbles were observed in the intestinal mucosa.

One case from the Robert Packer Hospital follows an appendent ony; the other follows a colostomy. The histories are as follows:

Case I.— Mrs. H.H., aged 20, stenographer, admitted to this clinic arch 3, 1804, complaining of pain and tenderness in the right lower abdomen, associated with nausea, vomiting and slight diarrhea. Examination revealed intense soreness and rightly in the right lower abdomen. Vaginal examination

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showed a small mass in the region of the right tube and ovary. The laboratory findings were: W.L.C. 11,000, polymorphonuclears SL., lymphocytes S.. Uring showed a cloud of albumin and many granular casts. T.P.E. 3.4 - 100 - 24. A diagnosis of acute perforated appendicitie was made. Indeciste appendentmy was performed through a McBurney musclesplitting incision. An acutely inflamed gengrenous perforated appendix was found lying behing the decum. A small abscess had formed. A right salpingitis known to be of long standing was also found. The absorbed was drained by two rubber drains.

The patient seemed listless after coeration, but aside from that there were no alarming symptoms. The temperature and pulse were as follows: 101 F - 100. Seventy-two hours after operation the skin of the lower right quadrant of the abdomen appeared bronzed and edematous and was crepitant upon palpation. The pulse rate rose rapidly to 124 per minute. These findings aroused the suspicion of a gas bacillus infection of the abdominal wall; hence immediate multiple incisions through the skin and subsultaneous tissues were made and a matery brownish, foul-smelling pus evacuated. There has no exidence that the deeper structures of the abdominal wall were involved by this infection. Anaërobic cultures were positive for bacillus aerogeneous capsulatus. The wounds here are are seed every four hours with normal saline solution. One numared and twenty hours later additional multiple incisions were made because the infection had continued to progress. After that the patient graupily improved and was lischarged as oured forty-nine days after the onset of the infection.

Case II. J.A.F., agad 35, an American, insurance agent, entered this clinic June 1, 12.5, complaining of severe pain in the right lumber region and the right lower abdomen. This attack had begun suddenly one any before admission. The pain had not been referred to any other parts, nor had it been associated with any nauses, vomiting or urinary symptoms. A similar attack one week previous to admission had subsided in three days. Attacks of pain in the right side acted back fifteen years. There had been no previous operations. Physical examination was negative except for slight distention, rightly over the entire right abdomen and very active peristalsis. The admission findings were: T.P.R. 99 - 74 - 20. ".B.C. 9,100, polymorphonuclears 81, small non-clears 19. Urine showed a few pus cells. Roentgenogram of the kilmsys and ureters was negative. A provisional magnesis of acute intestinal obstruction of unknown origin was made.

Immediate laparotomy through a right rectus incision was performed. An acute intestinal obstruction and to volvulus of the occum, ascending sclon and part of the transverse sclon was found. The volvulus was caused by adhesions between the ascending and transverse sclon. These adhesions were separated,

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1 $\epsilon imes \epsilon$ relieving the obstruction. Over-lietention of the large bonel was relieved by a decestomy fashoned after a litzal enterestany. Sixty-seven hours after operation the patient developed a gas babilius infection of all the structures of the absoning wall. The pulse rate at this time was 130 per minute. In addite multiple incisions were made through the skin, subsultaneous tiesues, fascia and underlying muscles. The wounds were dressed by the Carrel-D kin technic. Petient died ninety-six hours after operation in deep toxemia.

Note that in the first case the infection was limited to the superficial tissues only, while in the second case all the structures of the abdominal wall were involved.

Prompted by these two cases the following studies of intestinal flora were undertaken:

- 1. Bactericlogical studies of appendices removed at operation.
- 2. Pacteriological straies of appendiced abscesses.
- 3. Bacteriological studies of large gut and ileum.
- 4. Bacteriological studies of free pus in the peritoneal cavity.

Cultures were taken under aseptic conditions and planted in lithus milk. The resulting cultures were incubated continuously, the reactions being noted at twelve hour intervals. After seventy-two hours all cultures were examined microscopically. Cultures showing early stormy fermentation or rapid clotting of the milk, associated with the production of gas, were examined immediately for the presence of bacillus Telchii or other anaërobes. In all sixty-nine cultures were examined at varying periods after original cultures. These were distributed as follows:-

From appendiceal abscesses, 5.)

From lumen of excised appendix, 60.

From lumen of large gut, 2.

From free pus in peritoneal cavity, 1.

From lumen of excised ileum, 1.

of coil and gra, two within the traive hour period, while one sulture



showed no change whatever.

Thirty-seven cultures from excised appendices showed the pronuction of acid and gas associated with clot formation, one within twelve hours of original culture. Seventeen cultures showed only the production of acid, while in six cultures there was no change.

There was soil and gas production in all three cultures from the gut.

In the culture from pus in the peritoneal cavity, acia, but no gas, was produced.

Then examined microscopically none of these cultures showed the presence of bacillus Welchii or other anaërobes, nor did any of the patients from whom these cultures were taken levelop gas bacillus infection of any part. Wearly all positive cultures showed bacillus coli, diphtheroids or streptococci in varying combinations.

CONCLUSIONSO >

- I. Postoperative gas becilius infection of the abdominal wall is a very rare complication, but serious when it occurs.
- 2. There is relatively little risk as graproqueing anaerobas were not found in any cultures made.
- 3. Suspicion of such a complication should be aroused by a sudden increase in pulse rate, with or without a rise in temperature, in a patient who is not doing well after operation.
- 4. The diagnostic signs are copper colored bronging of the skin, with edema, brownish, foul-smelling discharge from the sound, crepitation, and positive bacteriological shears.
 - 5. Treatment should be prompt multiple incisions and free ar image.
 - 5. The winghosis depends upon the extent of the infection.

frequence,

7. = 4



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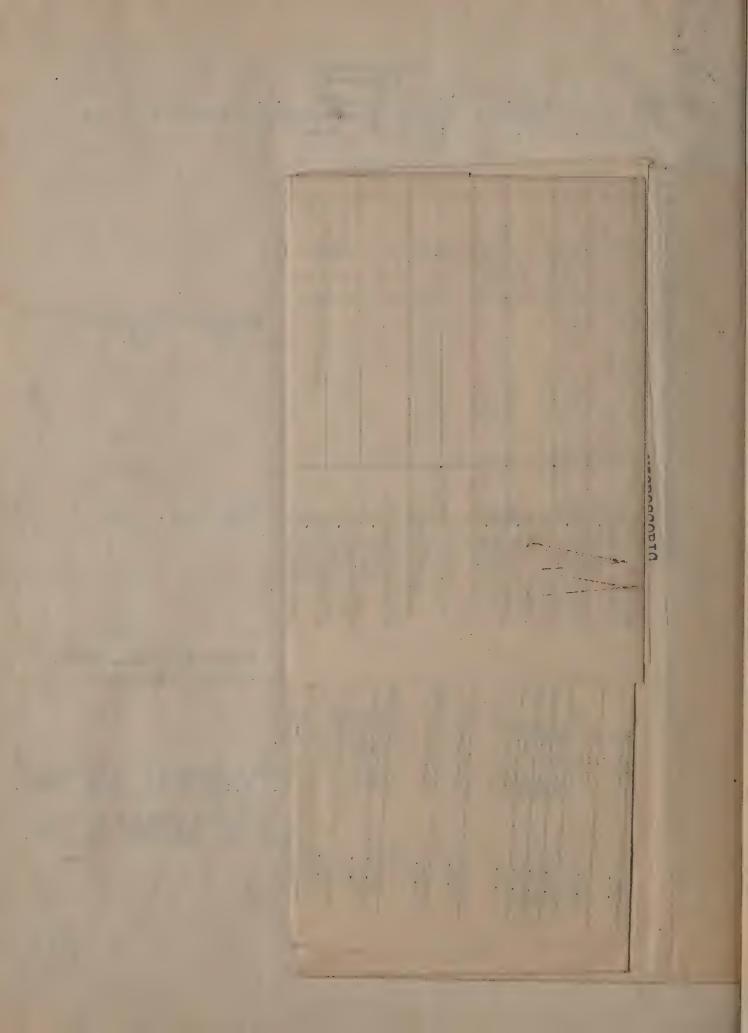
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RESULTS OF BACTERIOLOGICAL INVESTIGATIONS

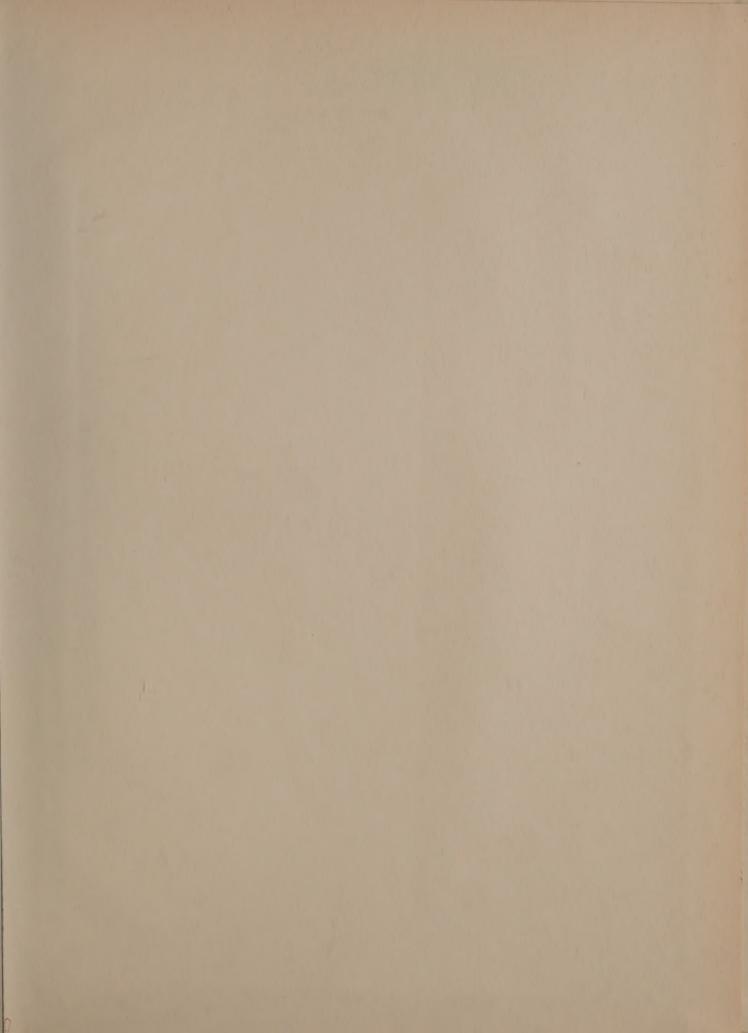
PATIENT	DATE OF ADMISSION	POSTOPERATIVE DIAGNOSIS	SOURCE OF CULTURE	Neg.		MUS MI 1d & (Acid & no Gas	MICROSCOPIC SMEARS OF CULTURES
мн	8-27-25	Appendicitis, chr.	*L.A.						Negetive
M.S.	8-31-25	Appendicitis, acute Hematogenous cyst	L.A.	-					Negative
L.C.S.	9- 1-25	ovary, right Appendicitis, acute	L.A.	-		-			Negative
2,0,0,	0 1-50	gangrenous, ruptured Subphrenic abscess	ш.ж.						мовачачо
R.Y.	9- 6-25	Appendicitis, acute gangrenous, ruptured	Free pus peritoneal					+	Negative
G.M.	9- 7-25	Appendicitis, chr.	Cavity L.A.						Negative
L.P.	9- 9-25	recurrent Abscess, appendiceal	*A				_	+	Anerobes -neg
M .B.		Auscess, appendiceal	A.			+			B. coli Negative
A.3.	9-11-05 9- 7-25	Appendicitis, sub-	L.A.			0-0		+	Negetive
M.H. J.B.	9-10-35 9-16-25	Appendicitis, acute Appendicitis, acute	L.A.					+	Negative Negative
R.A.	9-15-25	gangrenous, perforated Appendicitis, acute						+	Ne tive
H.A.	9-16-25	Typhoid fever Appendicitis, acute	L.A. L.A					+	Negative
0.0.	9-20-25 9- 4-25	Appendicitis, acute Adenocarcinoma cecum	L.A. Lumen cecum		+			7	Ne tive B. coli
G.A.	9-20-25	APPENndicitis, acute gangrenous	L.A.					+	B. col1
H.K.	9-25-25	Fibroid uterus Appendicitis, chr.	L.A.				+		B. coli
H.J. B.K.	9-25-1. 9-26-25	Appendicitis, acute Appendicitis, acute	L.A. L.A.				+	+	B. coli B. coli
T.B.	9-25-25	A PENdicitis, sub- acute	L.A.					+	B. coli Diphtheroias
A.L. A.W.	9-25-25 9-27-25	Appendicitis, chro. Appendicitis, acute	L.A.					+ +	Anerobes -neg B. coli
J.L.	9-29-25	Appendicitis, acute gangrenous	L.A.					+	B. coli
E.C.	9-31-25	Appendicitis, sub- acute	L.A.	-					Negative
B.W.	9-30-25	Appendicitis, sub- acute	L.A.					+	B. coli
W.L. E.R.	10- 6-25 10- 2-25	Abscess, appendiceal Appendicitis, acute	A L.A.		+		+		B. coli B. coli
E.W.	10- 6-25 10- 8-25	Appendicitis, acute Hernia, umbilical,	L.A. Lumen				+		B. coli B. coli
		strangulated with gangrene of ileum	excised ileum				+		
F.E.	10-12-25	Cholecystitis, chr. Appendicitis, chr.	L.A.				+		B. coli Staphlococci
H.C.	10-14-25	Cholecystitis, chr. with cholelithiasis	L.A.				+		B. coli
J.K.S.	10-12-25	Appendicitis, chr. Appendicitis, acute	L.A.		+				B. coli
H.P.	10-14-25	Appendicitis, chr.	L.A.				+		Streptococci B. coli
J.M.	10-15-25	Appendicitis, acute gangrenous, perforated	L.A.				+		B. coli
H.F. S.C.	10 -16- 25 10 - 18-25	Appendicitis, acute Appendicitis, acute	L.A.				+	+	Negative B. coli
H.H.	10-20-25	Appendicitis, chr.	L.A.				+		B. coli Diphtheroids
A.R.	10-20-25	Appendicitis, sub- acute	L.A.					+	B. coli
W.C. P.E.	10-22-25 10- 9-25	Appendicitis, acute Cholecystitis, chr.	L.A. L.A.				+ +		B. coli B. coli
V.H.	10-24-25	Appendicitis, chr. Appendicitis, acute	L.A.				+		B. coli
H.C. F.O.	10-25-25 10-26-25	Appendicitis, chr. Appendicitis, acute	L.A.			+	+		B. coli B. coli
D.R.	10-27-25	gangrenous, perforated Abscess, appendiceal	A		+				B. coli
A.F.	10-31-25	Appendicitis, chr. recurrent	L.A.			+			B. coli
s.c.	11- 9-25	Appendicitis, acute	L.A.		- 1		+		B. coli Diphtheroids
G.B.F. J.C.	11-10-25 11-10-25	Appendicitis, acute Appendicitis, acute	L.A.				+	+	B. coli B. coli
T.L.	11-13-25	Appendicitis, acute	L.A.				+	7	Streptococci B. coli
M.G.	11-16-25	Appendicitis, chr.	L.A.			,	+		Diphtheroids B. coli
C.L.	11-18-25	Cholecystitis, chr.	L.A.				+		Diphtheroids B. coli
0.D:	11-18-25	Appendicitis, chr. Fibroid uterus	L.A.				+		Dichtheroids B. coli
В.Н.	11-18-25	Appendicitis, chr. Appendicitis, sub-	L.A.		,		+		Diphtheroids B. coli
F.T.	11-18-25	Hernia, ventral	L.A.						Diphtheroids B. coli
		Appendicitis, sub-					+		Diphtheroids
D.O.	11-19-25 11-22-25	Retroversion, uterus Appendicitis, chr.	L.A.	-					Negative
J.S.	12- 5-25	Appendicitis, acute gangrenous, perforated Appendicitis, acute	L.A.	-					Negative
N.C.	12- 5-25	Appendicitis, acute	L.A.				+		B. coli Diphtheroids
2.0.	10-0-00	gangrenous	en é apr é				+		B. coli Streptococci
D.L.	12- 4-25	Appendicitis, chr. recurrent	L.A.				+		Diphtheroids B. coli Diphtheroids
R.W.	12- 7-25	Appendicitis, acute	L.A.			+			B. coli
A.W.	12- 6-25	Appendicitis, chr.	L.A.			T			Streptococci Diphtheroids
	2,0	Cholecystitis, chr. with stones	27 0 28 0				+		Yeast fungus
D.R.	12-13-25	Appendicitie, acute	L.A.			+			B. coli
R.C.	12-13-25	Hernia, inguinal Appendicitis, acute	L.A.			+			Diphtheroids B. coli
L.C.	12-16-25	Appendicitis, acute	L.A.			+			Streptococci B. coli
J.F.	12-21-25	A rendicitis, neute Gangrenous, perforated	L.A.				+		Staphlococci B. coli
R.F.	12- 7-25	Cholecystitis, chr.	L.A.				+		G.pos. cocci B. coli
R.N.	1-10-26	Appendicitis, chr. Appendicitis, acute	L.A.						Diphtheroids Large G. neg.
ш.ј.	1-10-26	gangrenous, perforated	L.A.				+		bac., B. coli, Diphtheroids
E.L.	1-10-26	Appendicitis, chr. recurrent Asscess, appendiceal					+		G.neg. bac. Diphtheroids
H.L.	1-11-26	Carcinoma, transverse	Lumen				+		Streptccocci G.neg. bac.
n. u.	1-7-20	colon	large gut				+		B. coli

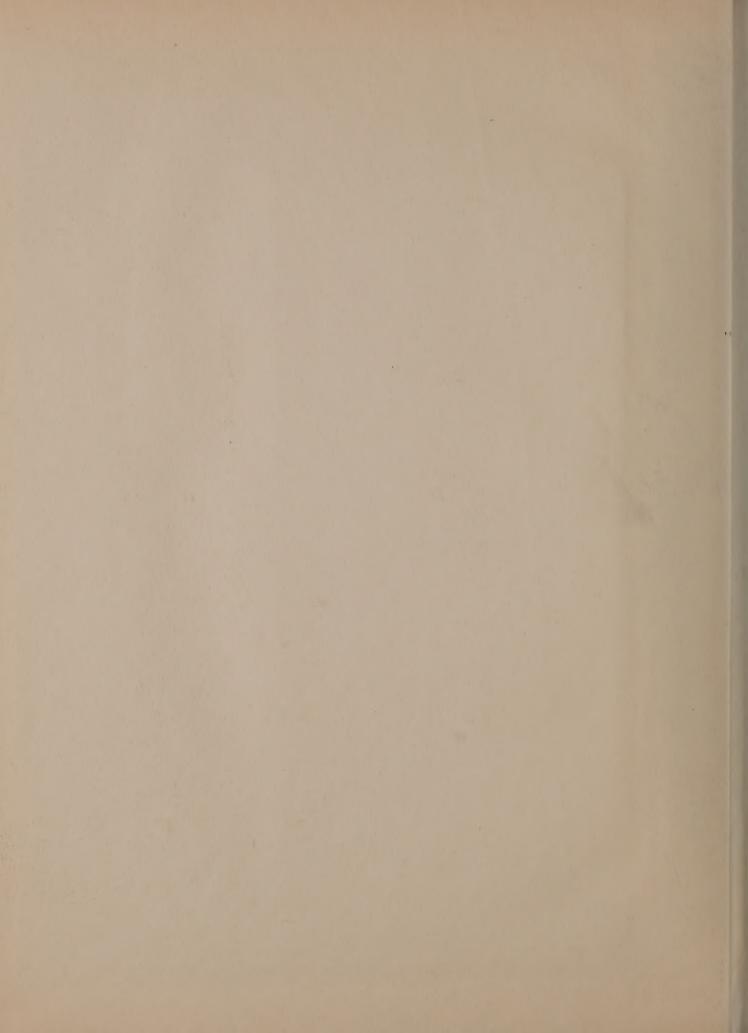
^{*}L.A. Lumen of excised appendix Appendiceal abscess













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